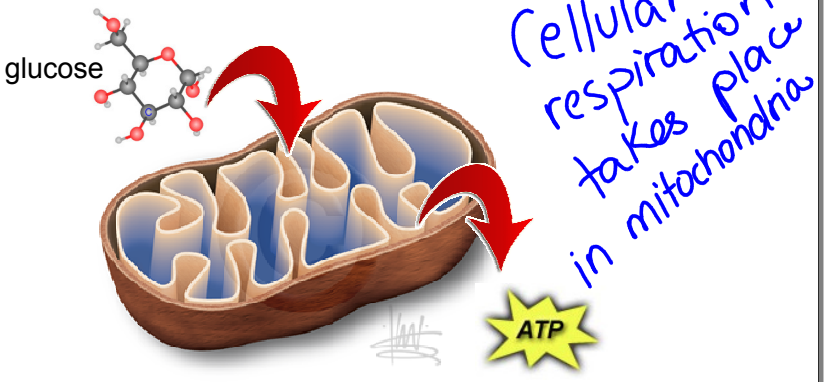
Standard: Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

Element: Explain the cycling of energy through the processes of photosynthesis and respiration.

EQ: What is cellular respiration?

Yesterday we learned that **photosynthesis** is a process used by plants to produce **glucose**.

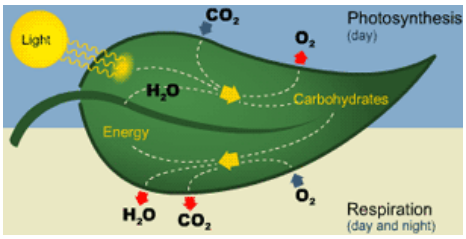
Both plants and animals use glucose in order to make **energy** in the form of **ATP**. This process is called **cellular respiration**.



Autotrophs can make their own food (glucose), but they still have to break it down to get **ATP**.

Heterotrophs cannot make their own food, which means they have to get the glucose they need by **eating other organisms**.

That means that BOTH **autotrophs** and **heterotrophs** use cellular respiration in order to break down glucose and make ATP.



Cellular respiration is the basically the same reaction as photosynthesis, only in **reverse**.

The materials made by photosynthesis (**glucose** and **oxygen**) are the same ones required for respiration.

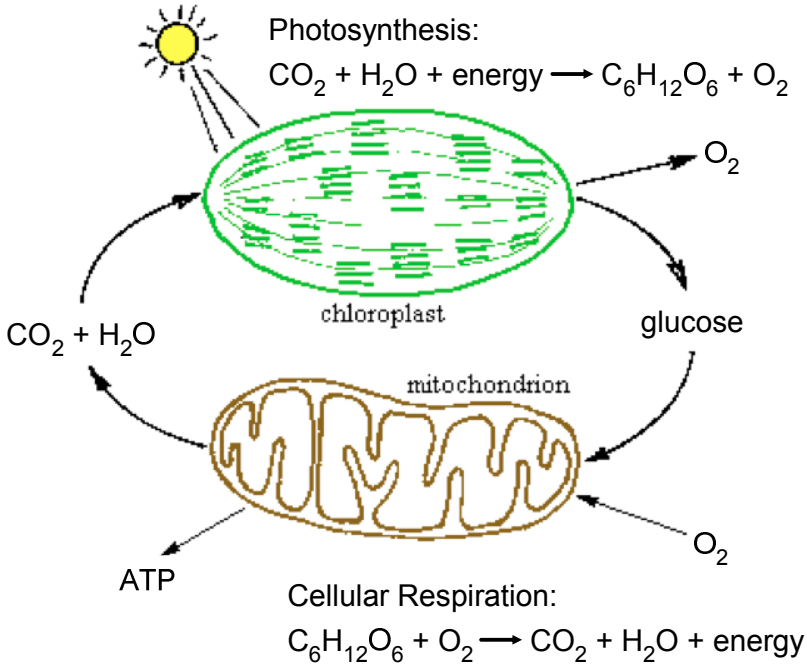
If we write the equation for photosynthesis:

carbon dioxide + water + light → glucose + oxygen

$$CO_2 + H_2O + \text{energy} \longrightarrow C_6H_{12}O_6 + O_2$$

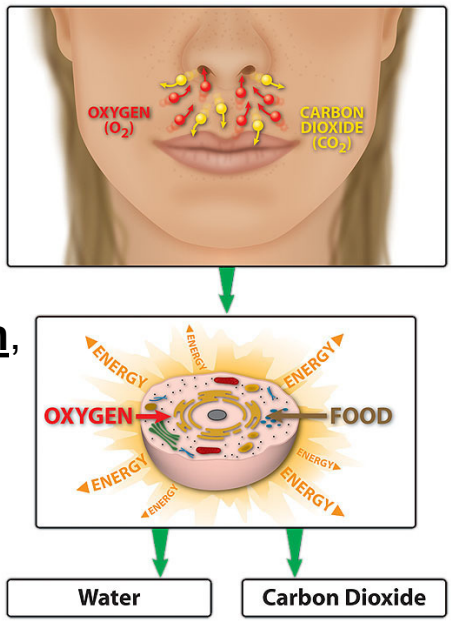
We can rearrange it to make the equation for cellular respiration:

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O + \text{energy (ATP)}$$



Since this type of cellular respiration requires oxygen, it is called **aerobic** respiration.

Aerobic respiration is very **efficient**, meaning that it can produce a lot of ATP (**energy**). That is why most organisms must breathe in **oxygen**, since it is required for aerobic respiration.



We exhale **carbon dioxide** because it is a waste product of cellular respiration.

It is possible for some organisms to survive without oxygen. These organisms are capable of **anaerobic** respiration, which means they are able to produce some ATP without having any **oxygen** present.

Anaerobic respiration produces much **less** energy than aerobic. This is okay for small **prokaryotes**, and some bacteria live in no-oxygen environments.

Your muscles start to burn when you exercise and they start to run out of **oxygen**. Since there isn't enough oxygen for **aerobic** respiration, your muscle cells must start **anaerobic** respiration. This causes a build up of **lactic acid**, which results in a burning feeling.